

DEVELOPMENT OF A MAXIMUM POSSIBLE EFFICIENCY FOR VAPOUR COMPRESSION REFRIGERATION CYCLE

Prepared by: Teoh Jun Seng

ABSTRACT

The report presents the investigation of development of the maximum possible efficiency for vapour compression refrigeration cycle (VCRC). As the refrigeration has become one of the basic needs to us, it is essential to optimize and enhance the system performance of the VCRC to minimize the resources used. The efficient energy utilization and optimization of VCRC can contribute in solving the problems of increasing energy demand, degradation of environment, global warming and depletion of ozone layer etc. With sufficient knowledge obtained through literature review, an Excel program is created to simulating the ideal VCRC for evaluation of various parameters. The results are then being compared, analyzed and discussed. The operating parameters which including evaporator and condenser temperature, temperature lift, superheating and subcooling temperature are primarily varied of fixed to find the pressure ratio, compressor power input, coefficient of performance (COP) etc. for evaluation of performance of VCRC. With R134a used as the refrigerant, the COP of VCRC is increases with increasing evaporator temperature and decreasing condenser temperature. The results also show that increase in superheating and subcooling temperature can benefit the system performance of VCRC. Next, different types of refrigerant which are including R134a, R12, R22, R717 and R744 are being analyzed and compared for their performance in VCRC. For the considered range of increasing evaporator temperature, R717 has the highest COP among the investigated refrigerants, followed by R12, R134a, R22 and R744. Next, when superheating is taken into considerations, it is noticed that no significant effect on all the investigated refrigerants. Superheating is only positively affects the COP of R134a and R744. Then, when taking into account the subcooling effect on the VCRC, the COP of all refrigerants is increasing when subcooling temperature is increasing with R134a has the highest COP. Based upon the results obtained, R134a is still the most suitable to be used as refrigerant for VCRC so far. However, R717 is believed can be a promising alternative refrigerant to R134a in near future.

Keywords: Coefficient of performance, condenser, evaporator, optimization, performance, pressure ratio, refrigerant, subcooling, superheating, vapour compression refrigeration